Anti Reflection Coatings
Prepared for S.C.C.O. Department of Continuing Optometric Education
AR coatings . . .

- were recently declared “The Ultimate Add-On” in an EYECARE BUSINESS article
- Many in the industry believe AR usage in the U.S. will explode in the next few years
- Understanding more about AR will be helpful as this growth occurs
AR usage

- Has grown considerably during the past two years
- It’s still in its infancy in the U.S.
  when compared to Europe, Canada and Japan
- The following chart reveals these startling differences
World-wide AR Usage
Special reasons . . .

- There are some unique reasons why AR coatings are so much more prevalent in Europe or Japan
Reason #1

- Lens manufacturers in other countries sell direct to retail offices, not through independent laboratories as in the U.S.
- There are only a few very large labs in those countries and each of them has AR coating facilities in-house
Reason #2

- Glass lenses are more common in those countries.
- Coating glass lenses is easier and less complex than coating plastic lenses.
- Glass AR coatings were used for years before the technique was developed for plastic lenses.
A growing market

- The U.S. market is expected to grow substantially in the next several years.
- Understanding AR technology will become an essential ingredient in modern eyecare.
- The following information is based on information published by the Optical Laboratories Association.
Early AR coatings

- were quite primitive and featured a single AR layer on each surface and produced 96 percent light transmission

- Two-layer coatings were later developed that increased light transmission to 97 percent
The current technology

- is a **multi-layer** coating
- It consists of 5 layers on each side of the lens
- The more primitive coatings can still be ordered but are considered out-of-date and seldom used
It’s not necessary . . .

- to understand the technology in order to prescribe AR coatings
- It helps, however, to be fully informed regarding how AR coatings work so they can be effectively explained to the patient
A scientific explanation

- The technology is very complex
- Understanding how it works is not particularly important
What is important

- is that even five-layer coatings are ultra thin
- So thin, they are measured in angstroms
An angstrom

- is less than a wavelength in thickness
- Imagine a single millimeter divided into 10 million parts
- One of those parts would equal an angstrom
An example

- Imagine a 150 story skyscraper with 1/4 inch of snow on the roof!
- That’s comparable to the relationship of an AR coating and a lens.
Single-layer coatings

- eliminate reflected light at a single wavelength
- This leaves some reflections remaining
- This is why modern multi-layer AR coatings are so much more efficient than earlier coatings
Adding additional layers

- eliminates additional wavelengths and remaining reflections
- Coating labs utilize sophisticated computers to determine the precise formula for each lens material
Light transmissions

- of different lens materials can vary quite substantially
- High index materials transmit less light than conventional glass or plastic
- Whatever light is not transmitted becomes reflected light
- The following graph illustrates this
Residual color

- No AR coating so far has been able to transmit 100 percent of light
- A faint residual color will be noticed on AR coatings
- The exact color shade is determined by the manufacturer and each goes to great lengths to maintain a consistency in that color
Patient Benefits

There are two distinctly different patient benefits to AR coated lenses and it is important to understand how they vary from one another.
1. The cosmetic benefit

- AR can make a vast difference in cosmetic appearance
2. The visual benefit

- The difference in night driving, for example, can be dramatic!
AR marketing

- often focuses solely on the cosmetic advantages of AR
- This is because cosmetic benefits are so easy to demonstrate, whether in demonstrations or in printed literature
Industry experts

- believe that emphasis on the visual benefits is of greater interest to more people
- They suggest that these visual benefits be discussed with the patient before the cosmetic benefits are explained
A review

Let’s review each patient benefit so you will be fully prepared to inform every patient about this modern new eyecare technology.
The cosmetic benefit

- AR reduces viewer-observed reflections
This is the best-known feature provided by AR coatings but is primarily of interest to those concerned about their appearance.
Eliminates

n The “coke bottle” look
This is also a cosmetic benefit but is extremely important to high myopes. Explain this benefit to anyone wearing -4.00 or higher.
The 2nd benefit is VISUAL

- Patients see better with coated lenses because their lenses transmit more light.
- Light transmission through conventional lenses increases from 91% to 99.5%.
- High index lenses gain an even greater increase (11 to 12%).
Ghost images are eliminated when AR is added.
This phenomenon is so normal to anyone wearing glasses, we tend to assume it goes with wearing glasses. AR eliminates these ghost images.
Night driving improves

- Annoying reflections from night time lights are eliminated
Those ghost images are most noticed at night and eliminating them is the most immediate benefit patients notice with their new AR lenses.
Back surface reflections

These are especially pronounced with flatter aspheric lenses
The use of aspheric lenses is another fast-growing market. Suggesting an AR coating for aspheric lenses should be routine as you dispense aspheric lenses.
Explaining AR

- First describe the visual benefits

- “YOU SEE BETTER WEARING AR LENSES”
Describing the visual benefits

- Remember to describe all of them
  1. Elimination of distracting reflections
  2. Vastly improved night vision
  3. And, if appropriate, elimination of power rings
Only then

- should you explain the cosmetic benefits
- “YOU LOOK BETTER WEARING AR LENSES”
Demonstrating AR

- Ideally, you will demonstrate both AR benefits
- Unfortunately, only the cosmetic benefits can be demonstrated
Your professional relationship

- with the patient now comes into play
- Patients come to you because of your technical knowledge and experience
They will . . .

- accept and appreciate your explanation of AR’s visual benefits
- Your professional advice is very important to them so don’t discount the importance of helping your dispenser by advising the patient on valuable premium addons such as AR
Never confuse . . .

- offering professional advice to your patients with “selling” products
- If you truly believe an AR coating will benefit the patient, explaining why and recommending AR is an expected part of your service to that patient
The only drawback to AR

- Until recently, AR coatings were difficult to keep clean.
- They required careful maintenance by the patient.
One of AR’s properties

- was responsible for the difficulty in keeping them clean
- On an uncoated lens, random smudges or finger prints are scarcely noticed
- They are concealed by reflected light!
Coated lenses

- Reveal every glitch and blemish on the pristine AR surface
- Minor blemishes never noticed before, suddenly stand out starkly on an AR coated lens
- While not a major problem, this phenomenon was a minor annoyance
An answer

- The top layer on the AR coating is quartz (a form of glass)
- Quartz is a “hydrophilic” material
- This hydrophilic surface allows oily smudges from finger prints and other debris to cling to the AR surface
A new technology . . .

- permits coating labs to apply a layer of silicon as a 6th layer
- This final coating is hydrophobic
- It has no effect on AR properties and light transmission remains 99.5%
- This final hydrophobic layer repels oils and makes the lens anti-static
Most coating labs

- provide this silicon treatment
- Many have coined their own trade name for the treatment
- Ask for a “hydrophobic” AR coating
The time factor

- Application of the AR treatment requires careful, time-consuming processing.
- It also requires highly specialized equipment.
- The equipment investment runs close to a million dollars.
Coating labs

- are running two and sometimes three shifts to expedite application of AR coatings
- Progressive labs have cut the added time required for AR coatings to a minimum
If you . . .

- Properly explain the AR story
- You’ll find patients are more than willing to wait a little longer for this modern technology
- Once they understand these are the finest, most modern lenses possible, time becomes much less important
An important competitive factor

- Most commercial chains are avoiding offering AR coatings to their customers
- AR coatings do not lend themselves to providing glasses “in about an hour”
- This has, effectively, given the AR market to private practitioners
Take advantage of this competitive advantage!
A new development

- Recently many lens manufacturers have added AR coated stock lenses to their line.
- This is a marvelous convenience for everyone.
- It means that single vision AR lenses can often be provided with the same turnaround time as conventional lenses.
AR factory-coated stock lenses

- are now available in conventional CR-39
- and high index plastic
- and now in polycarbonate
Edging AR coated lenses

- requires no special equipment
- Provide careful handling to guard against scratches
- AR coated stock lenses are responsible for most of the recent swell in AR usage
A word of caution

- Never use a factory-coated stock lens for one eye and send the other lens to a coating lab.
- A slight color variance will most likely occur.
- This has no effect on acuity but patients **ALWAYS** notice it and trying to explain the difference isn’t worth while.
Those mysterious scratches

Where do those hairline scratches come from that sometimes appear after AR coating?
Normal reflections

- can mask a multitude of minute surface imperfections
- Hairlines and blemishes sometimes mysteriously appear after AR coating
- The AR coating removes every reflection and minor blemishes that were unnoticed before, suddenly stand out
Laboratories

- have learned to take extra care and precautions in surfacing, polishing and finishing lenses that will be AR coated
- A lens with a perfect finish produces a perfect AR coating
- Careless handling prior to coating inevitably shows up once the lens is coated
Here are some helpful tips for use when dispensing AR lenses
Tinting

- When tinted lenses are to be AR coated, tint them 10 - 15% darker than the final shade.
- Then bleach them back to 5% darker than the final desired shade.
- This removes surface dye so you end up with coated lenses that are the desired shade.
UV dying

- Improper UV dying can be disastrous to an AR coating
- Maintain accurate dye temperature of 180 - 183° F
- Never overcook or boil the dye
More on dying

- If lenses have no scratch coating, never dye them for more than 10 minutes
- Ask your lab to recommend the best UV dye
Lens Treatments

- All color and UV tinting, edge polishing, engraving and faceting should be completed before lenses are sent to the AR lab.
- Decorative painting, grooving or edge painting can be accomplished after the lenses are coated.
Avoiding problems

- AR coating facilities need to know what they are dealing with when they coat lenses
- Here are some tips that can eliminate a lot of potential problems before they occur
Identification

- Coating labs often receive lenses with no identification of material or scratch coating.
- To avoid coatings that peel, craze or rub off requires the coater to know what they are dealing with.
- The index of refraction of AR coatings must match the lens index.
Coaters need to know

- if the lens was factory scratch coated and, if so, the brand of the lens
- They need to know if the lens has been UV dyed
- If the lenses are laminated (polarized), they need to know
More advice

- Always send full pairs to the coating lab, even if just one lens needs coating.
- Most coating facilities will strip the coating from the old lens and recoat both lenses together.
More advice

- This insures an exact color match
- If lenses are to be tinted, do not mix a stock lens with a surfaced lens
- Always wrap lenses in tissue or insert in a poly bag. Paper envelopes will scratch the lenses
Cleaning Do’s & Don’ts

- Use soap and water for cleaning lenses
- Avoid soaps with creams that leave deposits on lenses
- Never use abrasive soaps
More

- Best cleaner is Joy liquid detergent which has no additives
- Avoid Windex, acetone or caustic solutions
- Avoid ultrasonic cleaners
- Never insert coated lenses in high temperature salt pans
Conclusion

- Sooner or later, every eyeglass wearer will learn about AR coatings.
- Make sure it is your office that informs your patients.
- Your patients expect you to keep them informed about new developments in eyecare.
Lastly

- Patients want to look good in their new eyewear but they also want the best possible vision
- Review both benefits of AR (cosmetic and visual) with every patient
That completes this discussion of AR coatings